

BRAILLE AND TALKING BOOK READING:
A COMPARATIVE STUDY

By BERTHOLD LOWENFELD, Ph.D.

*Director of Educational Research
American Foundation for the Blind*

1945


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FOREWORD

Reading holds a central position in the education of blind children. This is so not only because it is the tool they need in order to follow the course of study in practically all the other school subjects but also because it opens to them the doors to a world from which they are more removed than are other children. We need only to call to mind how profoundly the invention of an embossed alphabet affected the education of the blind, and indeed the status of the blind in society, in order to evaluate the importance of reading for them.

Educators of blind children have always been aware of these facts and alert to improve methods of teaching braille. They recognize that the problem of teaching braille reading, complicated by the use of contractions, is as yet not satisfactorily solved.

The appearance of the Talking Book as a supplementary reading medium raises new questions in regard to reading speed, reading comprehension, and reading appeal. The study presented here offers some important findings on the comparative effectiveness of braille and Talking Book reading.

If one considers the many research publications in the field of visual reading it will be realized that this investigation is only a beginning in the study of Talking Book reading. It should be followed by other studies exploring problems such as those connected with retention, fatigue, spelling ability, and promotion of good speaking habits.

This study was conducted as a part of the Talking Book Education Project of the American Foundation for the Blind, made possible through a grant from the Carnegie Corporation.

ROBERT B. IRWIN, LL.D.

Executive Director

American Foundation for the Blind

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To the many who have assisted me in conducting the experiments and in reporting the results, I wish to acknowledge my indebtedness. Sincere thanks are due to the superintendents of the schools participating in the experiments, to the teachers with whom I had the pleasure of working, and to all the children in the schools for the blind who took part in the experiments. Most valuable suggestions were received from Dr. Harry Goldstein, Dr. Samuel P. Hayes, Dr. Robert B. Irwin, Dr. Irving Lorge, Dr. William A. McCall, and Dr. P. C. Potts, and to each of them I extend expressions of my sincere gratitude.

The Bureau of Publications of Teachers College, Columbia University, granted permission to use and reprint parts of the McCall-Crabbs *Standard Test Lessons in Reading* and Mr. A. C. Ellis, superintendent of the American Printing House for the Blind, Louisville, Kentucky, kindly cooperated by embossing in braille the tests needed.

B. L.

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CHAPTER I

INTRODUCTION

Reading of the Blind

The reading of the blind, from the beginning until about ten years ago, has been based on the assumption that touch must be substituted for sight. The first books for the blind used the ordinary letters of the alphabet in raised form—"talking to the fingers the language of the eyes."¹ Louis Braille, blind himself, emancipated reading and writing from the letter-forms of ordinary print by creating a system more adequate to the sense of touch, in which the letters of the alphabet are represented by various combinations of raised dots in cells two dots wide by three dots high. At the beginning of the twentieth century braille was internationally established as the unrivaled method of reading and writing for the blind. There were, however, a great many blind persons (about 75 per cent of the blind in the United States) who could not read braille at all or read it too slowly for effective use. They, like others, had a right to share in the distribution of knowledge and literature, but had to depend for their reading entirely on the service of seeing readers.

When Thomas Alva Edison in 1877 invented his Talking Machine, or phonograph, he anticipated its value for the blind: "Books may be read by the charitably inclined professional reader, or by such readers especially employed for that purpose and the record of such book used in the asylums of the blind . . ."² Edison's idea of employing his invention as a reading medium for the blind was brought to realization in 1932 by Robert B. Irwin, blind director of the American Foundation for the Blind. At present there are almost 30,000 Talking Book reproducing machines in use among the blind in the United States. A nationwide system of library service supplies Talking Book users with recorded editions of books of many types. This library service is free to blind readers, being financed by an annual government appropriation to the Library of Congress. Talking Book records are twelve-inch discs playing at 33 1/3 revolutions per minute, with fifteen to sixteen minutes of recorded text on each side.

¹ Villey, P. *The World of the Blind*. New York: The Macmillan Co. 1930. p. 39.

² Edison, Thomas A. "The Phonograph and Its Future." *North American Review*, May-June, 1878. pp. 527-536.

The advent of the Talking Book has profoundly influenced the reading habits of the blind in the United States. For example, it is reported that today in many libraries for the blind the demand for Talking Books is greater than for braille books and this in spite of the fact that the number of titles available in Talking Book form is only about one-fifth of those in embossed types.

It is only logical to ask how such a revolution in the reading of the adult blind affects the education of blind children. It is generally recognized that formal learning depends almost entirely upon the individual's ability to read. Reading comprehension and reading rate are the two main factors determining the pupil's efficiency in reading and are therefore of the utmost importance for his general progress in school. While there is apparently no limitation in comprehension imposed on the blind by the use of braille, there is one clear disadvantage to which braille readers are subjected—the slowness of braille reading with all its consequences. Hayes, in discussing retardation of blind pupils in intelligence and school achievement, states: "Slowness in tactual reading is doubtless a major cause for both types of retardation, limiting the range of general reading and setting definite limits to incidental learning."³ It appears then that blind children are necessarily curtailed in the acquisition of information and the enrichment of their experience derived from reading because they can read only a fraction of the amount that their seeing companions are able to cover in the same period of time. This situation is further aggravated by the fact that blind children must so frequently depend upon reading where and when seeing children need only incidental observation.

Educators of blind children have always been aware of their pupils' need for additional reading. Practically all schools provide for it by setting aside a number of hours a week in which teachers read aloud to a group of students certain study assignments or, more frequently, works of literature. It is therefore only natural that educators of the blind should be interested in the Talking Book as a means of providing their students with additional reading. However, before accepting a new reading medium they want to know its advantages and disadvantages, its assets and limitations.

Braille reading is reading by touch and Talking Book reading is reading by listening. Braille reading is a process which must be learned whereas Talking Book reading means listening to the spoken word—an ability which the normal child of school age has already acquired.

³ Hayes, Samuel P. "Psychology and the Home Teacher." *Outlook for the Blind*, April, 1941. p. 58.

The listener is not provided with the spelling of words as is the braille reader. However, braille reading gives little practice in spelling for it is done in thought units with brief fixations on separate letters. Spelling is much more closely connected with writing. The Talking Book has an asset of its own: the rendition of the text on records by professional readers gives the listener a standard of pronunciation and diction which cannot fail to promote good speaking habits. There is, however, a factor inherent in any auditory mode of reading which relegates it necessarily to a supplementary role in the education of the blind—it can serve only as a medium of reading. The blind student can read and write braille but by the Talking Book, at least in its present form, he can only read.

For these reasons the Talking Book as an educational medium can only supplement the braille system. As an additional medium it can help to make up for the main disadvantage of braille reading—its slowness—provided that deficiency in comprehension does not cancel the advantage of rate.

Purpose of the Study

The experiments of this study were designed particularly to compare speed and comprehension of braille reading with speed and comprehension of Talking Book reading and also to throw some light upon the problem of children's preferences for one or the other mode. The investigation of reading rates seeks to determine the extent to which Talking Book reading is faster than braille reading. The speed of Talking Book reading, which is relatively fixed, was easy to determine. Therefore, this part of the study concentrates on the investigation of rates of braille reading of pupils at different grade levels. The question in regard to comprehension is: How does Talking Book reading comprehension compare with braille reading comprehension at different grade levels, for different types of material, and for children of different levels of intelligence?

Related Findings

While this is the first study comparing touch reading and listening comprehension, considerable research has been done on the problem of visual reading and listening comprehension. Harry Goldstein in his *Reading and Listening Comprehension at Various Controlled Rates* reviews very adequately the results of research in this field up to 1940 and summarizes his review by stating: "The literature in the field, when restricted to published studies involving comprehension of meaningful material, reveals contradictory findings. Three studies favor the audi-

tory mode, while an equal number favors the visual mode."⁴ Goldstein's own study compares reading and listening comprehension at various rates of presentation on the basis of experiments with adult subjects. Of his many important findings the following have direct implications for the present study:

1. Listening comprehension is, in general, superior to reading comprehension.
2. The superiority of listening comprehension is decidedly more marked for the easy than for the difficult materials.
3. The difference in favor of listening comprehension is greater for the less intelligent groups.
4. Reading comprehension is more variable than listening comprehension.⁵

Preliminary data on the rate of braille reading were published by Hayes in 1917.⁶ On the basis of his experiments he reports, "... blind children read only about one-third as fast and write with a stylus only about one-half as fast as seeing children having the same number of years' experience in school work."⁷ He later states, in discussing the time allowance for a test in braille reading, "According to our experience the blind require from two and one-half to three times as long for such work."⁸

In Niday's "Report of a Nation-Wide Survey of Braille Reading" the following passage on the rate of braille reading can be found: "The number of words read per minute varied widely, too, of course. It ran from 2 to 120 in grade 3; 36 to 131 in grade 7; 6 to 95 in grade 12; with similar ranges in other grades. In the median scores here, grade 7 reads almost as fast as grade 8, and grade 11, a little faster than grade 12. The medians for grades 9 to 12 were very close."⁹ Niday used the Monroe Silent Reading Test, in which a question is asked after each of the 16 or

⁴ Goldstein, Harry. *Reading and Listening Comprehension at Various Controlled Rates*. New York: Bureau of Publications, Teachers College, Columbia University. 1940. p. 6.

⁵ *Ibid*, pp. 53, 60.

⁶ See Hayes, Samuel P. *Report of a Preliminary Test of the Reading of the Pupils of the Pennsylvania Institution for the Instruction of the Blind, at Overbrook, Pa.*, April, 1917. 20 pp.

⁷ Hayes, Samuel P. *Contributions to a Psychology of Blindness*. New York: American Foundation for the Blind. 1941. p. 233.

⁸ *Ibid*, p. 247.

⁹ Niday, W. Raymond. "Report of a Nation-Wide Survey of Braille Reading." *Thirty-fifth Biennial Convention, American Association of Instructors of the Blind*. 1940. p. 152.

17 exercises to be answered by rubbing out with the fingernail one of the words which appear in a row after the question. It can easily be seen—and is fully recognized by Niday—that the rubbing-out process done by blind children, replacing the underlining done by seeing children, influences the rate of reading considerably. For this reason Niday's findings are not directly comparable with those in the present study which used a rate based on reading that is not affected by any checking of questions during the reading of the passages.

CHAPTER II

THE EXPERIMENT

Materials

A preliminary survey of the available tests in reading showed that the *Standard Test Lessons in Reading*, prepared by William A. McCall and Lelah Mae Crabbs,¹ presented material that would lend itself readily to the experiments planned for this study. The *Standard Test Lessons in Reading* are, as pointed out by the authors in the Manual of Directions, the final products of years of experimentation and were "constructed and criticized by twenty experts in testing or teaching or both." The main purpose of these reading tests is twofold: "Not only is every test a lesson, but every test is a standard test." The *Standard Test Lessons* are offered to teachers "with confidence that their use will give pupils a rate of speed and power of comprehension exceeding that yielded by ordinary methods of teaching silent reading." They will give grade scores (G scores) which show "how well the normal or typical pupil would read these same lessons." The pupil's grade score is a measure that makes it possible to compare his comprehension score with the norm for his grade or to compare his score on one test with that of another.

The four books of *Standard Test Lessons in Reading* contain a total of 376 test lessons so arranged that Book II is for grades 2, 3, and 4; Book III for grades 3, 4, and 5; Book IV for grades 4, 5, and 6; and Book V for grades 5, 6, and 7.

The experiments of the present study were conducted in two series: Series I with pupils of the third and fourth grades; and Series II with pupils of the sixth and seventh grades. For the experiments in Series I, 24 tests were selected from Books II and III; for the experiments in Series II, 12 tests were selected from Books IV and V. Following are the numbers of the test lessons which were used in the experiments:

For Series I (grades 3 and 4)

From Book Two: 9, 18, 21, 25, 28, 34, 38, 52, 58, 59, 62, 68, 70, 73, 75, 81, 88.

From Book Three: 10, 12, 18, 29, 38, 49, 81.

¹ McCall, William A., and Crabbs, Lelah Mae. *Standard Test Lessons in Reading*. New York: Bureau of Publications, Teachers College, Columbia University.

For Series II (grades 6 and 7)

From Book Four: 25, 40, 49, 69, 78, 80.

From Book Five: 4, 8, 19, 20, 33, 48.

Each test lesson consists of a story or passage and eight to ten multiple choice questions dealing with the subject matter of the passage. The average number of words of the passages for third and fourth grades is 140. The passages of the test lessons for the sixth and seventh grades are considerably longer, averaging about 230 words each. The multiple choice questions gave four choices. The questions are "so worded that the pupils must learn to read very carefully or their answers will not be correct. . . . Some of the questions cannot be answered correctly by detailed reading only. The pupils must understand the selection as a whole, and be able to reorganize its parts, and even draw inferences from facts not overtly stated." Each test lesson is followed by an array of grade scores, scaled in tenths of a grade, corresponding to the number of questions answered correctly. "The score for each test lesson is in a form which shows a pupil's proper grade location in reading in a typical school. By averaging the scores for a series of lessons a very reliable grade placement can be determined."

Arrangement of the Experiments

The experiments were conducted in two series:

Series I (grades 3 and 4). A total of 24 test lessons were given to the children, 6 in each of the following four modes of presentation:

1. Braille reading (BR)
2. Talking Book recorded reading (TB)
3. Talking Book recorded reading with sound effects (TBS)
4. Talking Book recorded reading with dramatizations (TBD)

Series II (grades 6 and 7). A total of 12 test lessons were given to the pupils, 6 in each of the following two modes of presentation:

1. Braille reading (BR)
2. Talking Book recorded reading (TB)

The following remarks deal with the modes of presentation. The braille tests for Series I were printed in braille, grade one and also in grade one and a half; those for Series II only in braille, grade one and a half. (Braille, grade one is uncontracted; braille, grade one and a half uses certain standardized contractions.) The Talking Book tests were recorded on discs by experienced readers of the Talking Book studios of the American Foundation for the Blind, New York City. We are

indebted to Miss Ann Tyrrell, Mr. Alexander Scourby, and Mr. Eddie Ryan for their reading and to Mr. William Barbour and Mr. J. O. Kleber for their technical assistance in these recordings. The dramatizations were enacted by a number of actors and the sound effects on the Talking Book records were achieved by dubbing in the pertinent sounds from sound effect records. Only recordings of real sounds, and no imitations, were used. It may be added here that the reading was of excellent quality and the sound effects were as realistic as the standards of recording technique permitted. The Talking Book recording of passages in which dramatizations and sound effects were used necessitated only the substitution of direct for indirect speech or slight changes in the word order of the test material.

For Series I (grades 3 and 4), six test lessons were selected for each of the four modes of presentation, making a total of 24 test lessons. One test lesson in each mode was used only as a practice test to acquaint the children with the experimental procedure. The scores of these four practice tests were disregarded in the statistical analysis of comprehension results.

It was assumed that the standardized G scores correct for differences in difficulty of comprehension. To match the groups of tests in the four modes of presentation in regard to type of reading matter, careful consideration was given to the selection of tests in order to have test lessons of a similar type of reading matter represented in each of the four modes. Each mode of presentation included two test passages telling simple stories, one test passage of informational character, one test passage of descriptive nature, and one test passage presenting a story appealing to emotions. Characteristic examples of the tests used with the third and fourth grades are given in the Appendix.

For Series II (grades 6 and 7), six test lessons were selected for each of the two modes of presentation, making a total of 12 tests in this series. Three of the test passages in each mode were of the story-telling, narrative, type and three presented informational, textbook, material. Examples of both types as presented in each mode are given in the Appendix.

It is one of the characteristic differences between braille and Talking Book reading that the first mode allows for individual differences in reading rate while the second has a set speed. No time limits were set in the experiments because it was desired to compare spontaneous rate of braille reading and comprehension resulting from it with the rate of Talking Book reading and its comprehension results. Because of this omission of the time limits, the comprehension scores of the present

experiments are not directly comparable with the scores of seeing children on these tests.

All schools participating in the study were visited by the author in order to conduct the tests. The experiments were scheduled in each school over a period of five days; one morning and one afternoon period each day for third and for fourth grade, and one period a day for sixth and for seventh grade. As a rule, the children were tested in their customary classroom situation and every attempt was made to put them at ease during the experiments.

The following directions were given at the beginning of the experiments: "Today we are going to hear a few stories. I want you to listen very carefully to the Talking Book which is going to tell you some of the stories. Also, some stories you will read in braille and I would like you to raise your hand when you have finished reading the story, but there is no hurry finishing it, you just read the way in which you can best understand the story. After you have listened, or read, I will ask you a few questions about the story and you will write in braille a letter of the alphabet which will indicate the correct answer. In answering the questions you will have to make a choice between four answers. Each answer will be given to you together with one of the four letters: *l*, *m*, *n*, or *o*. All you have to do is to write the letter of the one answer you think is correct. Answers to all the questions of one story should be written in one line of your braille slate by putting the first answer in the first cell, the second answer in the second cell, the third answer in the third cell, and so on. I will gladly repeat any question you have not understood. You will learn how to do it with the first story. I think it will be fun to hear all the stories and to answer the questions. Try to do it as well as you can. Is there any question you want to ask? [All questions were answered as clearly as possible.] Now let's listen to a story." Before the braille stories were read the children were reminded to raise their hands when they finished reading.

To complete the information about the experimental setup it should be added that the questions were asked orally for all test lessons regardless of the mode of presentation. The answers of the pupils were written in braille using the letters *l*, *m*, *n*, *o* instead of *a*, *b*, *c*, *d* as given on the McCall-Crabbs tests. This change was necessary because in braille the letters *a*, *b*, *c*, *d* are written by punching one, two, three, and three dots respectively and, since in braille writing the stylus makes a noise in punching each dot, the identification of the letters by the number of punches would have been possible. Each of the letters *l*, *m*, and *o* consists of three dots, and *n* of four dots, therefore an identification of these

letters by sound was practically impossible. No difficulties were observed as a result of this change.

According to the directions, each child raised his hand when he had finished reading a braille test lesson. As a child raised his hand, the time he had taken to read the braille selection was recorded without referring specifically to the identity of the child.

Generally classes were taken separately; only in a few cases was it necessary, on account of schedule difficulties, to combine the third and fourth or the sixth and seventh grades. This was done only when the number of children in the combined classes did not exceed that of the larger separate classes in other schools.

Subjects

A. Schools and Numbers of Pupils. The experiments for this study were conducted in the first half of 1940 in the following twelve schools:

Illinois School for the Blind, Jacksonville
Indiana School for the Blind, Indianapolis
The Maryland School for the Blind, Baltimore
Michigan School for the Blind, Lansing
Missouri School for the Blind, St. Louis
New York State School for the Blind, Batavia
Ohio State School for the Blind, Columbus
Pennsylvania Institution for the Instruction of the Blind, Philadelphia
Perkins Institution and Massachusetts School for the Blind, Watertown
Tennessee School for the Blind, Nashville
Western Pennsylvania School for the Blind, Pittsburgh
Wisconsin School for the Blind, Janesville

(The Connecticut Institute for the Blind, Hartford, also cooperated but there the experiments were given only a preliminary trial.) The schools participating represent 40 per cent of the total enrollment of children in residential schools for the blind in the United States.

Practically all children of the third, fourth, sixth, and seventh grades in the twelve schools took part in the experiments. A total of 260 pupils completed all tests of Series I, 122 of these were in the third grade, and 138 in the fourth grade. A total of 221 completed all tests of Series II, 109 in the sixth grade and 112 in the seventh grade. The total number of pupils in both series of the experiment was 481.

The average number of pupils in a single third grade class was 10; in a fourth grade class, 11; in a sixth grade class, 9; and in a seventh grade class, 9. The smallest enrollment in any one class was 3 pupils and the largest was 20 pupils.

B. *Age-Grade Relationship.* A comparison between the grade placement and age of the pupils participating in the experiments makes it possible to determine, for the grades covered in this study, whether the age-grade relationship in schools for the blind is the same as that in public schools and, if not, what the differences are. In Table 1, column 2

TABLE 1
AGE-GRADE RELATIONSHIPS OF 481 BLIND PUPILS IN FOUR GRADES

Grade	N	Age		Actual Grade	Seeing Grade Norm	Seeing Age Norm for	Blind Grade	Blind
		Mean	S. D.		for Given Mean Age	Given Actual Grade	Retardation	Overage in Years
1	2	3	4	5	6	7	8	9
Third	122	11.4	2.12	3.7	6.1	8.9	2.4	2.5
Fourth	138	12.5	2.17	4.7	7.3	10.0	2.6	2.5
Sixth	109	14.9	2.14	6.7	10.1	12.0	3.4	2.9
Seventh	112	15.7	2.08	7.7	11.2	12.9	3.5	2.8

gives the number of pupils in each grade; columns 3 and 4 give the mean age of the blind pupils tested² and the standard deviation in years. Column 5 gives the actual grade as of the seventh month of the school year for each grade. (Since the experiments were carried out from the fourth month of the school year to the tenth month, the seventh month of a grade represents the average grade level of all the pupils at the time of the experiments.) Column 6 gives the seeing grade norm for the mean age as given in column 3, indicating the grade which seeing pupils of this age normally reach. Column 7 gives the seeing age norm for the actual grade as given in column 5, showing the age seeing pupils should normally be at the grade level of the time of the experiment.³ A comparison of the age norms with the actual mean ages of the experimental group reveals a considerable overageness of this group. Column 8 gives the grade retardation (difference between columns 5 and 6), and column 9 gives the number of years overage (difference between columns 3 and 7) of the experimental group. As can be seen from column 8 there is no great difference in amount of retardation between either of the

² Niday reports almost identical age averages for the 1123 pupils in grades 3, 4, 6, and 7 of his study; viz., 11.4, 12.8, 14.6, and 15.6 years respectively. From Niday, W. Raymond. "A Nation-Wide Survey of Braille Reading in Speed and Comprehension." (Unpublished master's thesis) Ohio State University. 1939. Table LI.

³ The data of columns 6 and 7 are taken from Table 21 in McCall, William A. *Measurement*. New York: The Macmillan Co. 1939. pp. 290-291.

two neighboring grades but a considerable difference between that of the two lower and the two higher grades. The increase in grade retardation from the third to the seventh grade is from 2.4 to 3.5 grades, indicating that, at least as far as this experimental group is concerned, the grade retardation increases with the grades. The overage, or age retardation, given in column 9, is practically the same for the two neighboring grades but increases slightly, from 2.5 to 2.8 years, from third to seventh grade. These data on retardation and its increases conform with similar conclusions reported by Hayes.⁴

C. IQ Distribution. Table 2 presents information on the distribution of IQ's of the pupils in the four grades. Not all of the schools had available records of intelligence quotients of their pupils. This explains the fact that the distribution of IQ's covers a smaller number of pupils than the total number participating in the study.

IQ's—most of them based on the Hayes-Binet Intelligence Test and a few on the Kuhlmann-Anderson Intelligence Test—were available for 92 pupils in third grade, 107 pupils in fourth, 81 pupils in sixth, and 92 pupils in seventh grade.

TABLE 2
DISTRIBUTION OF IQ'S OF THE PUPILS IN THE FOUR GRADES

IQ Groups	Grade 3		Grade 4		Grade 6		Grade 7	
	N	%	N	%	N	%	N	%
Below 90	28	30.4	36	33.7	21	25.9	16	17.4
90—109	39	42.4	41	38.3	31	38.3	44	47.8
110 and above	25	27.2	30	28.0	29	35.8	32	34.8
Total	92	100.0	107	100.0	81	100.0	92	100.0
Median IQ*	100.9		97.3		102.3		102.2	
Mean IQ*	101.5		99.1		102.4		104.8	
S. D.	18.0		19.1		15.1		16.9	

*Based on distribution by IQ deciles.

The data of Table 2 show that the average IQ's of both the third and the fourth grade group correspond closely to the expected IQ average of 100, while those for the sixth and for the seventh grade group are somewhat above. It must be taken into consideration that only pupils who were able to read braille well enough to read the test material used for their grade could participate in the experiments, therefore the IQ averages found are higher than they would have been if all pupils in these grades had been included.

⁴ See Hayes, Samuel P. *Contributions to a Psychology of Blindness*. New York: American Foundation for the Blind. 1941. pp. 278-283.

CHAPTER III

THE DATA AND RESULTS

The data and the results of this investigation are presented and discussed under three headings: (1) Rates of Braille and Talking Book Reading, (2) Comprehension of Braille and Talking Book Reading, (3) Children's Preferences.

Rates of Braille and Talking Book Reading

Rate of Braille Reading in the Four Grades. Since the available literature on braille reading does not present any definite data on the rate of braille reading attained by pupils at various grade levels, it was decided to investigate this problem within the framework of this study so far as it could be done without complicating unduly the experimental arrangement. As already explained in Chapter II under "Arrangement of the Experiments" the pupils were asked to read the braille tests at their accustomed rate while keeping in mind that they would have to answer questions checking their understanding of the material read. Since some of the Talking Book tests were given to each group before any of the braille tests, the children realized that they had to read the braille stories carefully in order to be able to answer the questions. As each pupil raised his hand when he finished reading the passage, the time was recorded. The identity of the pupil, however, was lost after his time had been recorded. No attempt was made to correlate reading rate and reading comprehension because this would have led to considerable complications in the experimental arrangement.

Practically all pupils read their braille tests in braille, grade one and a half; only a few children in the third grade had to use braille, grade one because they were not sufficiently trained in reading the contractions of braille, grade one and a half.

The data from one school had to be omitted in the analysis of braille reading rate because schedule difficulties made it impossible to test each grade separately and therefore no rate records by grades were obtained.

The rate averages are presented separately for each grade. They are based on the total time needed by the pupils for reading all six braille test lessons.

The fact that the lower and upper grade groups had to read different material—different not only in content, but also in degree of difficulty, since it was graded to the respective grade levels—has an advantage and a disadvantage. The advantage is that each group was kept interested in the material presented and a natural reading situation

prevailed because the content and vocabulary corresponded to the grade level of the pupils. The disadvantage is that the rates of reading in the upper and lower grade groups cannot properly be compared because the more difficult test lessons of Series II use longer and more complex words than those of Series I. A change from the passages of Series I to those of Series II would slow down even an accomplished braille reader in the number of words read per minute.

TABLE 3
RATES OF BRAILLE READING (NUMBER OF WORDS PER MINUTE)

<i>Grade</i>	Q_1	Q_2 (Median)	Q_3	<i>Range of the Middle 80 Per Cent</i>	<i>Maximum Rate</i>
Third (N=108)	38	51	67	29— 90	189
Fourth (N=127)	45	58	79	36—105	230
Sixth (N=99)	42	59	74	29— 93	152
Seventh (N=101)	50	62	76	33— 93	132

Table 3 presents data on the rate of braille reading in the four grades. It shows the number of words read per minute at Q_1 , the point below which 25 per cent of the distribution falls; at Q_2 , which is identical with the median, the point below which and above which 50 per cent of the cases lie; and at Q_3 , the point above which 25 per cent of the cases lie. Besides the rate for each quartile the table shows the range in rate for the middle 80 per cent of the pupils, a measure which eliminates the erratic extreme rates for the lowest and highest 10 per cent of the pupils. The last column gives the maximum rate for each group, indicating the number of words read per minute by the speediest reader at each grade level.

The four median rates show that the reading speed increases from grade to grade, being 51 for third grade, 58 for fourth grade, 59 for sixth grade, 62 for seventh grade. Between third and fourth grades this increase is considerable and between sixth and seventh grades it is small. The median for sixth grade indicates practically no increase over that of fourth grade if taken at its face value. Actually, there is a hidden increase in speed because the greater difficulty of the reading material of the upper grades mentioned above necessarily exerts a retarding influence. Control experiments with experienced adult braille readers resulted in a decrease in rate of about 16 per cent when changing from the easy third and fourth grade material to the more difficult sixth and seventh grade material. Therefore, since the sixth grade pupils with more difficult material read about the same number of words per minute

as the fourth grade pupils do with the easier test lessons, the conclusion seems justified that they have actually increased their speed for easy material by about one-sixth. For the median rate this "hidden increase" amounts to about 10 words per minute. The lower quartile, Q_1 , and the upper quartile, Q_3 , also show a steady increase from third to seventh grade provided allowance is made for the afore-mentioned increased difficulty in reading material.

While the extreme lowest rate can be of no practical value, because only pupils who were able to read the tests in a reasonable length of time participated in the experiments, the maximum rate of reading achieved in each of the grades is of some interest. The fastest reader in the third grade group read 189 words per minute; in the fourth grade group, 230; in the sixth grade group, 152; and in the seventh grade group, 132 words per minute. Of course, these maximum rates have no significance for any one grade since an extremely rapid reader may happen to be in any of the grades at a particular time.

Variation in Rate of Braille Reading, by Schools. Besides the statistical treatment of braille reading rates of pupils in each of the four grades, the data make it possible to compare achievement in rate of braille reading from school to school. Table 4 presents the median rates of braille

TABLE 4

MEDIAN RATES OF BRAILLE READING (WORDS PER MINUTE) IN FOUR GRADES OF ELEVEN SCHOOLS

SCHOOL	SERIES I				SERIES II			
	THIRD GRADE		FOURTH GRADE		SIXTH GRADE		SEVENTH GRADE	
	<i>Median</i>		<i>Median</i>		<i>Median</i>		<i>Median</i>	
	<i>N</i>	<i>Number of Words</i>	<i>N</i>	<i>Number of Words</i>	<i>N</i>	<i>Number of Words</i>	<i>N</i>	<i>Number of Words</i>
A	10	36	11	46	11	47	8	68
B	6	53	8	64	4	70	7	74
C	8	56	9	74	11	39	12	54
D	20	58	6	77	7	65	3	77
E	17	56	14	58	12	74	14	66
F	10	62	15	53	9	47	10	50
G	8	62	13	50	13	67	8	54
H	9	53	16	70	9	51	13	58
I	7	64	14	65	7	76	11	65
J	5	36	12	56	9	67	7	79
K	8	35	9	36	7	49	8	62
Range of Medians	35-64		36-77		39-76		50-79	

reading in the four grades of eleven schools. In addition to the median rate, the number of pupils is given for each grade as an indication of the reliability of the reported median. Even if we approach with great caution the interpretation of the data—which taken by grades frequently rely upon small numbers—one conclusion can safely be drawn: There are great differences in median rate for any one grade from school to school.

In the group of third grades the lowest median is 35 (school K) and the highest is 64 (school I)—a reading rate of almost twice as many words per minute; in the fourth grade the lowest median is 36 (school K) and the highest, 77 (school D)—more than twice as much; in the sixth grade the lowest median is 39 (school C) and the highest, 76 (school I)—again almost twice as much; and in the seventh grade, where the smallest difference is found, the lowest median rate is 50 (school F) and the highest, 79 (school J). These striking differences indicate that some teachers have succeeded in achieving in their classes a median rate of braille reading about twice that of the same grade in other schools.

In order to find out whether a uniformly slow, medium, or fast rate prevails in all four grades of the same school, or whether the reading rate accomplishment is different from grade to grade within a school, a division of the median reading rates into “slow,” “medium,” and “fast” groups was made. This was done by classifying for each grade the three schools with the lowest rates as “slow” and the three schools with the highest rates as “fast,” leaving five schools ranking as “medium.” Table 5 shows, for each school, which grades belong in each of the three rate groups. The first five schools listed have at least two grades with slow rates and none, or not more than one, with a fast rate. The last five schools have no grade with a slow rate, the four grades being placed in the medium and fast groups. This seems to indicate that, so far as the four grades in this study are concerned, the pupils of one school tend to belong either to the group of slow rate readers or to that of fast rate readers.

The data on braille reading rates given in this part of the study will enable teachers of these four grades to compare the achievement of their pupils in rate of braille reading with standards derived from a representative sample of the blind school population of the respective grades. However, the figures presented should be regarded as evidence only of the braille reading rate as it existed at the time of this investigation with the particular material used and not as fixed standards for possible achievement. Purposeful efforts of teachers of braille reading might well raise the general status of reading reported in this study. It is en-

tirely possible that even schools achieving a comparatively high median rate might improve the rate of braille reading of their pupils considerably if particular attention is given to this aim. However, a word of caution must be added: An increase in rate of reading is no achievement unless a satisfactory level of comprehension is maintained.

TABLE 5
BRAILLE READING RATE RANKING OF FOUR GRADES IN ELEVEN SCHOOLS

SCHOOL	GRADES		
	<i>Slow Rate</i>	<i>Medium Rate</i>	<i>Fast Rate</i>
A	Third Fourth Sixth	Seventh	
K	Third Fourth	Sixth Seventh	
C	Sixth Seventh	Third	Fourth
F	Sixth Seventh	Fourth	Third
G	Fourth Seventh	Sixth	Third
J	Third	Fourth Sixth	Seventh
E		Third Fourth Seventh	Sixth
H		Third Sixth Seventh	Fourth
B		Third Fourth	Sixth Seventh
D		Third Sixth	Fourth Seventh
I		Fourth Seventh	Third Sixth

Comparison of Rates of Braille and Talking Book Reading. The rate of braille reading for each group is based on the combined data from individual pupils, while the rate of Talking Book reading is fixed for all

pupils in each group by the reading speed of the narrator. The narrator of the text on a Talking Book record reads with a fairly constant speed which cannot be changed by the listener unless he retards or accelerates the turntable speed which normally is $33\frac{1}{3}$ revolutions per minute. The reading speed of Talking Book presentation for adult material is about 180 words per minute.¹ Reading of educational material is done at a somewhat slower rate. In these experiments the mean rate of Talking Book reading of the passages for the third and fourth grades was 171 words per minute and of those for sixth and seventh grades, which contain more difficult and longer words, 158 words per minute.

How do these rates compare with the previously reported rates of braille reading? Table 6 shows, for each of the four grades, the number of words read in braille during the length of time needed to read 100 words on the Talking Book. The figures are presented at the three

TABLE 6
COMPARISON OF SPEED OF TALKING BOOK AND BRAILLE READING

GRADE	<i>Number of words read in braille for each 100 words read on Talking Book</i>		
	<i>Q₁</i>	<i>Q₂ (Median)</i>	<i>Q₃</i>
Third	22	30	39
Fourth	26	34	46
Sixth	27	37	47
Seventh	32	39	48

quartile points. It can be seen from *Q₂* (median) in this table that one-half of the pupils in the third grade read less than 30 words in braille for each 100 words on the Talking Book; in the fourth grade, less than 34 words; in the sixth grade, less than 37 words; and in the seventh grade, less than 39 words. This means that the average braille reading rate as determined in this study is about one-third of the Talking Book reading rate. The number of words given in the column headed *Q₁* indicates that the slow-reading quartile of pupils in the four grades read less than 22, 26, 27, and 32 words respectively in braille for each 100 words read on the Talking Book. The figures for *Q₃* indicate that

¹ Rodenberg, Lewis W. "The Story of Books for the Blind." *What of the Blind? A Survey of the Development and Scope of Present-Day Work with the Blind*. Vol. I. Edited by Helga Lende. New York: American Foundation for the Blind. 1938. p. 172.

only the fast-reading quartile of the pupils in the four grades read braille at a rate faster than 39, 46, 47, and 48 words respectively for each 100 words on the Talking Book, which approximates half the rate of Talking Book reading.

The fact that Talking Book reading is on the average about three times as fast as braille reading can be expressed in other words as meaning that the Talking Book enables pupils to cover about three times as much reading material as they can get by touch reading in the same amount of time, thus reducing the educational handicap imposed by the exclusive use of braille.

In an educational evaluation of the usefulness of the Talking Book its faster reading rate will count as an important asset.

Comparison of Braille and Talking Book Reading Rates with Visual Reading Rates. After the comparison of rates of braille reading with those of Talking Book reading it remains to be shown how both rates compare with norms for silent reading rates of seeing pupils at the same grade level. In searching the literature on reading for such norms only a few recent studies were found that give reading rates for the grades with which the present study is concerned. It is recognized that each individual has varied reading speeds which he employs according to the material to be read and the purpose of his reading. For this reason it would have been best to compare the braille reading rates found in this study with the visual reading rates of children using the same test material under the same conditions. But since the *Standard Test Lessons in Reading* do not give rate scores—they limit the time allowed for reading and answering the test questions—it was necessary to make use of norms presented in other studies and in speed of reading tests.

Table 7 presents the data for a comparison of rates of braille reading with rates of visual silent reading. The norms for visual reading as reported by Cole,² Durrell,³ and Taylor,⁴ are followed by those given in the Manual of Directions of *The Chicago Reading Tests*⁵ and by the median rates for braille reading found in the present study. The rates given by Cole present "the average speed per grade under ordinary methods of teaching"; those given by Durrell are based upon "data from

² Cole, Luella. *The Improvement of Reading, with Special Reference to Remedial Instruction*. New York: Farrar and Rinehart. 1938. p. 50.

³ Durrell, D. D. *Improvement of Basic Reading Abilities*. New York: World Book Co. 1940. p. 143.

⁴ Taylor, Earl A. *Controlled Reading*. Chicago: University of Chicago Press. 1937. p. 126.

⁵ Englehart, Max D., and Thurstone, Thelma G. "Manual of Directions." *The Chicago Reading Tests*. Milwaukee: E. M. Hale and Co. 1939.

studies made in the Boston University Educational Clinic"; and Taylor reports that his norms were obtained from 2000 subjects "trained by traditional methods in silent reading of graded material."

In surveying the most widely used reading tests it was found that most of those which include any test of speed, measure speed and comprehension together either by inserting in the reading material questions checking comprehension or by counting only sentences or passages that were comprehended correctly. The Chicago Reading Tests use material very similar to that of the tests used in the present study and also give separate tests for the third-and-fourth grade level and the sixth-and-seventh grade level. The Manual of Directions gives norms for the median rate at the different grade levels. These norms are included in Table 7.

TABLE 7
RATES OF VISUAL READING AND RATES OF BRAILLE READING

SOURCE	GRADES				
	<i>Third</i>	<i>Fourth</i>	<i>Fifth</i>	<i>Sixth</i>	<i>Seventh</i>
Cole	95	153	189	215	237
Durrell	125	156	180	210	
Taylor	115	168	190	200	210
Chicago Reading Tests	126	178	188	221	222
Braille reading	51	58		59	62

The comparison of rates in this table reveals that on the third grade level seeing pupils read on the average at least twice as fast as braille readers. The rate of visual reading increases sharply from third to seventh grade while that of braille reading shows a gradual and not very marked increase. Consequently it is found that rates of visual reading are on the fourth grade level about three times as fast as those of braille reading, on the sixth grade level about three and a half times as fast, and on the seventh grade level about four times as fast. In other words, blind fourth grade pupils read on the average about one-third and blind seventh grade pupils only about one-fourth as much as their seeing companions read in the same amount of time.

When the Talking Book reading rates—171 words for the third and fourth grade material, 158 words for the sixth and seventh grade material, and 180 words for adult material—are compared with the visual silent reading rates it is found that average visual readers from the fifth

grade on have a speed which surpasses that of Talking Book reading of adult material.

These findings are of course true only for the status of braille reading at the time of this study and are subject to change if either braille or visual reading rates are generally improved. They reveal however the present extent of the limitation imposed on blind children by the slowness of touch reading.

Comprehension of Braille and Talking Book Reading

In attempting to evaluate the relative effectiveness of braille and Talking Book reading in regard to comprehension, the usual procedure of comparing two methods by the use of matched groups received first consideration. In such experiments, one group is subjected to one method, in this case braille reading, and a matched group to the other method, in this case Talking Book reading. The results of both experiments are then compared and tested for statistical reliability. In attempting to set up matched groups with blind children one meets with almost unsurmountable difficulties. These may be due to any or all of the following reasons:

1. The total number of children in schools and classes for the blind is comparatively small (about 6,300 in the United States) and, naturally, still smaller when an experiment is limited to certain age groups.
2. Schools for the blind are scattered all over the country.
3. Intelligence quotients are not available for all children, since intelligence testing is not practiced in all schools for the blind.
4. There is great variation in degree of vision and age at onset of blindness among children in schools and classes for the blind. The children range from those with total blindness to those with 20/200 visual acuity. They may be born with eye conditions resulting in the above-described range of vision or they may have become visually handicapped at any age between birth and the time they were admitted to a school or class for the blind.

It was therefore decided to use matched standardized tests, and to give these to a representative sample of pupils in schools for the blind. As described in the section, "Arrangement of the Experiments," an equal number of tests were presented in each of the four modes of reading for Series I and in each of the two modes of reading for Series II. The number of correct answers of each pupil to the multiple choice questions following the reading matter of the tests was converted into a G score according to the standardized scale provided with each test. These G scores formed the material for the statistical analysis presented in this section.

Comprehension Differences between Braille and Talking Book Reading, Series I (grades 3 and 4). Table 8 presents the mean scores and standard deviations for each mode of reading for the third and for the fourth grade. These data are derived from the distribution of the total scores made by each pupil on the five tests in each of the four modes. The means therefore represent the total of five G scores. The scores were supplied by 122 pupils of the third grade and 138 pupils of the fourth grade. The third and fourth grades show the same order in comprehension results for the four modes: the highest mean score is in Talking Book straight reading; Talking Book reading with sound effects comes next; then braille reading; and the lowest mean score is in Talking Book reading with dramatizations.

TABLE 8
MEAN COMPREHENSION SCORES AND STANDARD DEVIATIONS IN THE FOUR
MODES OF READING, SERIES I

GRADE	N	BR		TB		TBS		TBD	
		Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Third	122	26.80	3.34	28.73	2.91	28.38	3.79	25.88	3.61
Fourth	138	27.45	2.95	29.39	2.41	28.88	3.36	26.57	2.73

The difference between the means of Talking Book straight reading and Talking Book reading with sound effects is very small and, as will be seen later, insignificant. It appears, therefore, that the addition of sound effects to the reading of the passages did not influence the comprehension results.

It was unexpected that the dramatized form of Talking Book reading should render mean scores so much below those of the other Talking Book modes, particularly since dramatized test lessons ranked high in the children's preferences. (See section on "Children's Preferences.") As further data on correlations and reliability will show, comprehension results of this mode deviate considerably from those of the other three modes. An explanation of this fact may be suggested. The test lessons used in the experiments were comparatively short. The use of various voices representing persons in the story introduces an element which might well add to the appeal of the presentation but at the same time interfere with an understanding of the content. A voice which appears only for a very short time, a sentence or two, does not become sufficiently established and might only serve as a factor on which the attention centers at the cost of comprehension. To be concrete, a pupil

listening to a dramatized Talking Book passage hears the narrator telling the story. At the moment the dramatization sets in, his attention is diverted from the subject matter of the story to the newly appearing voice of the actor. Before this interest subsides he may have lost the thread of the story, or the story may even be finished. Thus an extraneous factor interfering with the child's attention comes into play and this may explain the low comprehension scores of Talking Book reading with dramatizations as well as other statistical divergencies found in the scores resulting from this mode of reading. Further test experiments with longer dramatizations should be undertaken to permit definite conclusions on the value of dramatizations in Talking Book reading.

How reliable are the differences found between the modes of presentation or, in other words, are the differences so large that they could not occur by chance? Table 9 supplies the statistical data answering this question. The table gives, for the third and fourth grade separately, the difference between two means, the standard error of the difference, the product-moment coefficient of correlation, and the ratio of the difference to its standard error, i.e., the critical ratio. Since the means in these tests are correlated, the standard errors of the differences between means were calculated according to the long formula:

$$SE_{Diff.} = \sqrt{SE_{M_1}^2 + SE_{M_2}^2 - 2rSE_{M_1} \cdot SE_{M_2}}$$

TABLE 9

RELIABILITY OF DIFFERENCES BETWEEN TALKING BOOK READING AND THE OTHER THREE MODES, SERIES I

<i>Grade</i>	<i>Modes of Reading</i>	<i>Diff. of Means</i>	<i>SE_{Diff.}</i>	<i>r</i>	<i>CR</i>
Third	TB—BR	1.93	.232	.67	8.32
	TB—TBS	0.35	.193	.83	1.81
	TB—TBD	2.85	.217	.75	13.13
Fourth	TB—BR	1.94	.218	.56	8.90
	TB—TBS	0.51	.195	.73	2.62
	TB—TBD	2.82	.187	.64	15.08

The critical ratio is significant⁶ for Talking Book reading as compared with braille reading and for Talking Book reading as compared with Talking Book reading with dramatizations in both third and fourth grades. It falls short of significance for Talking Book reading as compared with Talking Book reading with sound effects in both grades. As

⁶ As customary, a critical ratio of 3 is taken as evidence of significant difference.

shown in Table 8, the differences are always in favor of Talking Book reading.

Having determined the reliability of the differences between the means of the four modes of presentation, it remains to be explained of what quantitative value the differences are. Since the means were derived from the grade scores of five test lessons for each pupil, the differences between two means express the accumulated differences between five test scores in one mode and five test scores in another mode. Therefore, the differences must be divided by five in order to reduce them to the grade score level. It is then found that comprehension scores of Talking Book reading are superior to those of braille reading by 3.9 months in both grades; to those of Talking Book reading with sound effects by .7 and 1.0 months; to those of Talking Book reading with dramatizations by 5.7 and 5.6 months, in third and fourth grade respectively. The great quantitative differences between Talking Book reading and Talking Book reading with dramatizations and also the high critical ratios may find their explanation in the previously mentioned assumption that a multiplicity of voices has a distracting effect in such short passages.

It may therefore be concluded that, so far as the experiments with third and fourth grade pupils are concerned, comprehension of Talking Book straight reading is significantly superior to that of braille reading by a margin of about 4 months in grade score achievement. The difference in comprehension between the mean scores of Talking Book reading and Talking Book reading with sound effects is very small and statistically not significant. Further experiments with longer passages would be necessary to reach any conclusion in regard to the differences in comprehension of Talking Book reading and Talking Book reading with dramatizations.

Comprehension Differences between Braille and Talking Book Reading by IQ Groups, Series I (grades 3 and 4). In addition to the differences in reading comprehension reported for the third and the fourth grade groups, this chapter deals with a comparison of Talking Book reading comprehension and braille reading comprehension of pupils belonging to different IQ groups. IQ's were available for a total of 199 pupils; 92 of them in third grade and 107 in fourth grade. The scores of these pupils were divided into three groups according to the pupils' IQ rating. The first group included 64 pupils having IQ's below 90; the second group, 80 pupils with IQ's from 90 to 109; and the third group, 55 pupils with IQ's of 110 and above.

Table 10 shows the mean scores for braille and Talking Book reading comprehension arranged by IQ groups. As would be expected, the

mean scores for both modes of reading show an increase from the lower to the higher IQ groups. This increase is much smaller for Talking Book reading than it is for braille reading. In Talking Book reading, comprehension alone accounts for the increase, while in braille reading, skill in the mechanics of reading is an additional factor contributing to the more pronounced increase.

TABLE 10
MEAN SCORES IN BRAILLE AND TALKING BOOK READING BY IQ GROUPS, SERIES I
(GRADES 3 AND 4 COMBINED)

MODE OF READING	IQ GROUPS			TOTAL <i>N</i> = 199
	<i>Below 90</i> <i>N</i> = 64	<i>90-109</i> <i>N</i> = 80	<i>110 and Above</i> <i>N</i> = 55	
TB	28.19	29.21	30.22	29.16
BR	25.47	27.25	28.93	27.14
TB Superior	2.72	1.96	1.29	2.02

In comparing the mean scores of the two modes, it can be seen that Talking Book reading comprehension is superior to braille reading comprehension for all three IQ groups. The differences in favor of Talking Book reading, however, decline from the lowest to the highest IQ group. (The trend is essentially the same if comprehension scores are tabulated for third and for fourth grade separately.) This decrease in superiority of Talking Book reading comprehension finds its explanation in the above-mentioned greater skill in braille reading which the more intelligent pupils have acquired on this grade level.

It may therefore be concluded that in the present experiments pupils of lower intelligence comprehend considerably better by Talking Book reading than by braille reading, while the more gifted children comprehend well by either mode of reading although there is still a difference in favor of the Talking Book. This suggests the particular usefulness of Talking Books (and other auditory methods) in classes of retarded children. This finding corresponds with that of Goldstein's study, viz., "The difference in favor of listening comprehension is greater for the less intelligent groups."⁷

Variability of Test Scores, Series I (grades 3 and 4). The question as to which mode of reading results in scores of larger or smaller varia-

⁷ Goldstein, *op. cit.* p. 60.

bility is of considerable educational interest. The differences in mean scores have already been discussed and it was found that Talking Book straight reading results in significantly higher comprehension scores than braille reading. But which mode of reading renders a set of scores least dispersed or scattered?

A comparison of the standard deviations for each mode of reading and a testing of their differences for significance will make it possible to answer this question. Table 11 presents the pertinent data for third and fourth grades. The standard deviations for fourth grade are consistently lower than those for third grade, which indicates a trend toward consolidation in scores from third to fourth grade.

The formula for the standard error of the difference between two standard deviations if the number of pupils is the same is:⁸

$$SE_{SD_1 - SD_2} = \sqrt{\frac{SD_1^2 + SD_2^2 - 2r^2SD_1SD_2}{2N}}$$

TABLE 11

RELIABILITY OF DIFFERENCES BETWEEN STANDARD DEVIATIONS OF THE FOUR MODES OF READING, SERIES I

<i>Third Grade</i>	<i>TB</i>	<i>BR</i>	<i>TB</i>	<i>TBS</i>	<i>TB</i>	<i>TBD</i>
SD	2.91	3.34	2.91	3.79	2.91	3.61
Diff.		.43		.88		.70
SE _{Diff.}		.211		.177		.204
CR		2.04		4.97		3.43
<i>Fourth Grade</i>	<i>TB</i>	<i>BR</i>	<i>TB</i>	<i>TBS</i>	<i>TB</i>	<i>TBD</i>
SD	2.41	2.95	2.41	3.36	2.41	2.73
Diff.		.54		.95		.32
SE _{Diff.}		.191		.175		.169
CR		2.83		5.43		1.89

The critical ratio shows the reliability of the obtained differences. It can be seen from Table 11 that the standard deviations for Talking Book straight reading are smaller than those for the other three modes in both third and fourth grades. The critical ratio of the difference between the standard deviations of braille and Talking Book reading is 2.04 for the third grade and 2.83 for the fourth grade. The first ratio indicates that chances are 98 out of 100, and the second 99.74 out of

⁸ Peters, Charles C., and Van Voorhis, Walter R. *Statistical Procedures and their Mathematical Bases*. New York: McGraw-Hill Book Company. 1940. p. 182.

100,⁹ that there is greater variability in braille scores than in Talking Book straight reading scores. This means practically complete reliability, particularly when it is considered that the standard deviations for Talking Book scores are smaller in spite of the fact that the means, as shown in Table 8, are higher. The standard deviations for Talking Book reading with sound effects and for Talking Book reading with dramatizations are, with one exception, still larger than those for braille reading. The critical ratios indicate that the differences reported in Table 11 are reliable except in the fourth grade between Talking Book reading and Talking Book reading with dramatizations, where the lower critical ratio may be due to chance.

The data serve therefore as evidence that Talking Book reading results in a more homogeneous group of comprehension scores than does braille reading. If sound effects or dramatizations are added to Talking Book reading, the variability of comprehension scores increases considerably, even beyond that of braille reading; in other words, sound effects and dramatizations exert an influence on comprehension which accentuates the differences from pupil to pupil.

Comprehension Differences between Braille and Talking Book Reading, Series II (grades 6 and 7). In the analysis of comprehension results for third and fourth grade pupils no attempt was made to differentiate between the kinds of material presented in the test lessons. As already pointed out, care was taken in the selection of the test lessons for these two grades in order to have the various types of reading matter represented equally in each mode of reading. However, since practically all of the test lessons for these two lower grades are written in a story-telling form, even if they are informational in character, no strict differentiation in kind of material seemed possible.

The experimental arrangement for sixth and seventh grade groups provided for a differentiation in kind of material: three test lessons dealing with "stories" and three test lessons dealing with "textbook" matter were presented in each mode. From the samples of test lessons given in the Appendix the difference in kind of material can easily be recognized. In *story* test lessons, the reading matter is narrative in form, telling a story; in *textbook* test lessons, the reading matter is informational and written in the form in which textbooks of various subjects (e.g., geography, nature study, social science) usually present their factual information, i.e., without a narrative sequence.

The test lessons for sixth and seventh grades were given in only

⁹ See Garrett, Henry E. *Statistics in Psychology and Education*. New York: Longmans, Green and Co. 1938. p. 213. Table 34.

two modes of reading: braille and Talking Book straight reading. Six test lessons were presented in each of the two modes, three of them were *story* test lessons and three were *textbook* test lessons. The scores were supplied by 109 pupils of the sixth grade and 112 pupils of the seventh grade.

Table 12 presents the means and standard deviations for each of the two modes of reading for *story* and for *textbook* tests separately. It will be noted that the scores for *story* tests are consistently higher than those for *textbook* tests in braille as well as in Talking Book reading.

TABLE 12
MEAN COMPREHENSION SCORES AND STANDARD DEVIATIONS IN THE TWO MODES OF
READING, SERIES II

GRADE	N	STORY TESTS				TEXTBOOK TESTS			
		BR		TB		BR		TB	
		<i>Mean</i>	<i>S.D.</i>	<i>Mean</i>	<i>S.D.</i>	<i>Mean</i>	<i>S.D.</i>	<i>Mean</i>	<i>S.D.</i>
Sixth	109	23.04	3.77	23.65	3.57	22.67	3.25	21.08	3.21
Seventh	112	25.06	3.50	24.91	3.43	23.76	2.80	22.41	3.08

Since the test lessons have been standardized with seeing children, the two kinds of tests should yield approximately equal grade score means within the same mode of reading. From the difference found it may be concluded that the group of blind children as a whole did not comprehend *textbook* material, which is informational in character, as well as they did *story-telling* material because of a specific effect of blindness. In reporting the results of the Pressey Test of Practical Information with 257 blind pupils Hayes concludes: "As one might expect, the blind are distinctly below the seeing in general information, the curves indicating an apparent retardation of four years in each age group from ten to sixteen and of five years in the seventeen- and eighteen-year groups."¹⁰ Two factors contribute to this restriction in the informational background of blind children: Their handicap in the perceptual field cannot but result in a restriction in the range and variety of ideas and concepts, and the slowness of braille reading further limits their acquisition of information. While this limitation in informational background may not seriously interfere with the comprehension of story

¹⁰ Hayes, Samuel P. *Contributions to a Psychology of Blindness*. New York: American Foundation for the Blind. 1941. p. 214.

material, it is bound to affect the comprehension of informational material.

In turning to a comparison of mean scores for Talking Book and braille reading it will be found that the differences for *story* tests are very small and inconsistent, slightly in favor of Talking Book reading in the sixth grade and slightly in favor of braille in the seventh grade. In the *textbook* tests, however, the means for braille reading are considerably higher than those for Talking Book reading in both grades.

How reliable are the differences between the two modes of reading for *story* and for *textbook* material? The statistical data answering this question are presented in Table 13. (For the standard errors of the differences, the long formula, given previously, was used.) For both grades, the difference between Talking Book and braille reading comprehension of *story* tests is not only quantitatively small but also not significant as shown by a critical ratio of less than 3; 2.07 for sixth grade and .49 for seventh grade. The data for the *textbook* test lessons in both grades show a considerable difference in favor of braille. These dif-

TABLE 13

RELIABILITY OF DIFFERENCES BETWEEN MEAN SCORES IN BRAILLE AND TALKING BOOK READING, SERIES II

Grade	Modes of Reading	Diff.	SE _{Diff.}	r	CR
Sixth	Story: TB—BR	0.61	.295	.65	2.07
	Textbook: BR—TB	1.59	.276	.60	5.76
Seventh	Story: BR—TB	0.15	.304	.57	0.49
	Textbook: BR—TB	1.35	.268	.54	5.04

ferences are statistically significant with critical ratios of 5.76 for sixth grade and 5.04 for seventh grade.

What is the quantitative value of the differences found? The mean scores represent the grade score sums of three test lessons. The differences must therefore be divided by three in order to be reduced to the grade score level. For *story* tests, the difference between Talking Book and braille reading is 2.0 months in favor of Talking Book for the sixth grade, and .5 months in favor of braille for the seventh grade. These small differences are, as pointed out above, statistically not significant. The difference between braille and Talking Book reading comprehension for *textbook* test lessons, however, is 5.3 months for the sixth grade and 4.5 months for the seventh grade; these considerable differences, both in favor of braille, are statistically significant.

It may now be concluded that, so far as the present experiments with sixth and seventh grade pupils are concerned, comprehension of *text-book* material by braille reading is significantly superior to comprehension of the same kind of material by Talking Book reading. The margin found was 5.3 and 4.5 educational months for sixth and seventh grades respectively. For the *story-telling* material, there is no significant difference between Talking Book and braille reading comprehension.

The fact that comprehension of *story* tests is less affected by the mode of reading than comprehension of *textbook* tests may be explained by what Goldstein calls the hypothesis of "past practice and habituation."¹¹ Blind pupils are used to comprehending stories by listening since the greater part of their comprehension of story-telling material is through the medium of speech in their daily lives. However, when it comes to comprehension of informational material they are more used to touch reading because they acquire most of their formal knowledge from textbooks printed in braille. The differences revealed in this study are not to be considered as permanently established, for increased habituation to the Talking Book might produce different results.

Comprehension Differences between Braille and Talking Book Reading by IQ Groups, Series II (grades 6 and 7). In order to determine how braille and Talking Book reading comprehension compare at different levels of intelligence, the scores were divided into three groups according to IQ's of the pupils. These data are presented in Table 14. IQ's were available for a total of 173 pupils: 81 of them in the sixth grade and 92 in the seventh grade. The first group included 37 pupils having IQ's below 90; the second group, 75 pupils with IQ's from 90 to 109; and the third group, 61 pupils with IQ's of 110 and above.

From the results previously given it would be expected that, since braille and Talking Book reading show no significant differences for *story* tests, the scores divided for the three IQ groups would also give no conclusive differences. The differences found are slightly in favor of braille for the lowest IQ group and slightly in favor of Talking Book for the other two IQ groups. As expected these differences do not give any conclusive evidence of the superiority of one or the other reading mode in the *story* tests.

The *textbook* tests which yielded a significant difference in favor of braille in both grades show considerable differences in each IQ group also; the difference in favor of braille is largest for the lower IQ group, smaller for the middle, and still smaller for the higher IQ group. This

¹¹ Goldstein, *op. cit.* p. 58.

TABLE 14
MEAN SCORES IN TALKING BOOK AND BRAILLE READING BY IQ GROUPS,
SERIES II (GRADES 6 AND 7 COMBINED)

MODE OF READING	STORY				TEXTBOOK			
	IQ GROUPS				IQ GROUPS			
	110				110			
	<i>Below</i> 90 N=37	90-109 N=75	<i>and</i> <i>Above</i> N=61	<i>Total</i> N=173	<i>Below</i> 90 N=37	90-109 N=75	<i>and</i> <i>Above</i> N=61	<i>Total</i> N=173
TB	21.62	24.27	26.12	24.35	19.70	21.62	23.22	21.77
BR	22.00	24.04	25.52	24.13	21.75	22.96	24.12	23.11
TB Superior		.23	.60	.22				
BR Superior	.38				2.05	1.34	.90	1.34

leads to the conclusion that there is no great difference in comprehension of *textbook* material between braille and Talking Book reading for the more intelligent pupils but that there is a considerable difference in favor of braille reading for pupils of average and lower intelligence. (The same trend is revealed if data on IQ groups are tabulated separately for sixth and seventh grade pupils.)

The following explanation is suggested for these findings. Pupils on the sixth and seventh grade level have already achieved considerable skill in braille reading. They can adjust their reading speed to suit their comprehension and they can reread words or phrases if they do not get the idea at the first "touch." The Talking Book reading of the present experiments did not provide for changes in speed or for any rereading. These advantages inherent in braille reading weigh more for the less intelligent pupils than for those with higher IQ's, who are able to comprehend well either by braille or by Talking Book within the given range of speed and without repetition.

Variability of Test Scores, Series II (grades 6 and 7). The variability of test scores is indicated by the standard deviations given in Table 12. The standard deviations, when compared for the two modes of reading, show only small differences. The largest difference between standard deviations is found for the *textbook* tests of the seventh grade in which the standard deviation for braille reading is 2.80 and that for Talking Book reading is 3.08. This difference of .28 when tested for significance gives a critical ratio of 1.20, which means that it is statistically insignificant. The other differences also do not reach the level of significance.

It may therefore be concluded that in the present experiment with sixth and seventh grade pupils comprehension scores for braille and Talking Book reading are not different in variability or, in other words, they show the same amount of scatter for both modes of reading.

Correlation between Comprehension Scores and IQ's, Series I and II. There are numerous studies available reporting correlations between mental capacity as measured by intelligence tests and reading achievement as measured by silent reading tests. Ladd summarizes some previous investigations into the relation between reading tests and intelligence tests as follows: "It seems that correlations between reading and Binet intelligence tests average about .50, but may be greater or less according to the range of the group tested."¹² Goldstein reports for his adult subjects correlations of .68 to .75 for reading and for listening comprehension with standardized intelligence measures.¹³

Table 15 presents the product-moment coefficients of correlation, for third and for fourth grade, between the scores for each of the four modes of reading and the intelligence quotients, and, for sixth and for seventh grade, between the scores for each of the two modes of reading and the intelligence quotients. As already stated, practically all of the

TABLE 15
CORRELATIONS BETWEEN READING COMPREHENSION SCORES AND INTELLIGENCE QUOTIENTS

FACTORS	GRADES							
	Third (N=92)		Fourth (N=107)		Sixth (N=81)		Seventh (N=91)	
	r	P.E.	r	P.E.	r	P.E.	r	P.E.
BR and IQ	.36	.06	.55	.05	.41	.06	.42	.06
TB and IQ	.30	.06	.40	.06	.53	.05	.55	.05
TBS and IQ	.34	.06	.54	.05				
TBD and IQ	.22	.07	.51	.05				

IQ's available were obtained by the use of the Hayes-Binet Intelligence Test. The correlations for the third grade are rather low, which can be explained by the fact that at this grade level pupils are not sufficiently experienced in braille reading. The correlations for fourth, sixth, and

¹² Ladd, Margaret Rhoads. *The Relation of Social, Economic and Personal Characteristics to Reading Ability*. New York: Bureau of Publications, Teachers College, Columbia University. 1933. pp. 21-22.

¹³ Goldstein, *op. cit.* p. 51.

seventh grades vary from .40 to .55, conforming with those generally reported for reading and intelligence. As the probable errors indicate, these correlations are significant (indicative of a true correlation greater than zero).

Reliability of Tests, Series I and II. The reliability of a test is frequently determined by correlating two parallel forms of the test. The correlation between the two forms is taken as a measure of the self-correlation or reliability of the test. The different groups of *Standard Test Lessons* used in this study actually constitute parallel forms of reading comprehension tests since they are parts of a series of uniformly standardized test lessons.

Table 16 gives, for third and for fourth grade, the correlations between Talking Book reading and the three other modes and, for sixth and for seventh grade, the correlations between Talking Book and braille reading. All correlation coefficients indicate substantial correlations, as would be expected from tests measuring the same ability.

TABLE 16
CORRELATIONS BETWEEN COMPREHENSION SCORES IN THE VARIOUS MODES
OF READING

MODES OF READING	GRADES							
	Third (N=122)		Fourth (N=138)		Sixth (N=109)		Seventh (N=112)	
	r	P.E.	r	P.E.	r	P.E.	r	P.E.
TB and BR	.67	.03	.56	.04	.75	.03	.61	.04
TB and TBS	.83	.02	.73	.03				
TB and TBD	.75	.03	.64	.03				

Goldstein reports for his adult subjects a correlation between reading and listening comprehension of .78.¹⁴ The comparable correlations in the present study, those between braille reading and Talking Book reading (listening), are .67, .56, .75, and .61 for the four grades. The addition of sound effects to the Talking Book narration has already been characterized as the least influential change and, as expected, the correlation coefficients between Talking Book reading and Talking Book reading with sound effects approximate most closely those of a self-correlation, being .83 and .73 for third and fourth grades respectively. The correlations reported in Table 16 indicate a very considerable reliability of the tests as used in this study.

¹⁴ Goldstein, *op. cit.* p. 51.

Variation in Comprehension Scores of Braille and Talking Book Reading, by Schools. A comparison of grade scores in braille and Talking Book reading comprehension achieved in the twelve schools participating in this study is presented in Table 17. As already pointed out in Chapter III under "Rates of Braille and Talking Book Reading," the number of pupils in some of the classes is rather small. For this reason the conclusions reached cannot be as definite as those in the rest of the study where the statistical analysis is based on data accumulated from the twelve schools. The number of pupils is given with each median score and must be taken as an indication of reliability whenever the achievement of an individual class is considered. The median, indicating the point below which and above which 50 per cent of the scores lie, has been used in the presentation of these data because it is not affected by extreme cases which distort the mean. The medians of course vary from grade to grade and from school to school. Among the third and fourth grades, the lowest median G score in braille reading comprehension is 5.1 and the highest, 6.0. Among the sixth grades, the lowest is 6.1 and the highest 8.7; and among the seventh grades, the lowest is 7.3 and the highest 9.1. The range of median scores for Talking Book comprehension is somewhat narrower than that for braille reading comprehension with the exception of the seventh grades. The differences from school to school, particularly in the two higher grades, are very considerable.

There are some schools that show either consistently low or consistently high achievement in all four grades. School H has low medians in all grades and school J in all but the sixth grade. High medians are found in all grades of schools B and D. It is interesting to note that schools B and D are also among those with high rates of braille reading (see Tables 4 and 5). Since the present study was not designed to investigate the correlation of comprehension and rate in braille reading, this observation is only mentioned parenthetically.

The fact that some schools show either low or high comprehension achievement in all four grades may be explained either by a genuine difference of comprehension ability among the pupils of the schools in question—and this difference would have to be quite considerable; or by teaching methods which in one case are conducive to the development of reading comprehension (and perhaps also reading rate) and in the other are not; or by a combination of both. This problem, however, goes beyond the scope of this study and needs specifically designed research.

Comparison of Reading Scores with Age of Pupils. It has already been stated that the omission of time limits for the tests in the present

TABLE 17
 MEDIAN GRADE SCORES IN BRAILLE AND TALKING BOOK READING COMPREHENSION IN FOUR GRADES OF TWELVE SCHOOLS

SCHOOL	THIRD GRADE			FOURTH GRADE			SIXTH GRADE			SEVENTH GRADE		
	N	BR	TB	N	BR	TB	N	BR	TB	N	BR	TB
A	10	5.1	5.9	11	5.9	6.2	11	7.8	7.3	8	8.5	9.0
B	6	5.9	6.0	8	6.0	6.2	4	8.5	7.6	7	8.7	8.1
C	8	5.2	5.8	9	5.9	5.8	11	8.0	8.4	12	8.7	8.6
D	20	6.0	6.2	6	5.9	6.2	7	8.7	7.9	3	9.1	9.1
E	17	5.4	5.5	14	5.8	5.7	12	7.7	7.7	14	8.7	8.1
F	10	5.5	5.6	15	5.8	6.1	9	6.2	6.7	10	7.3	7.1
G	8	5.2	5.6	13	5.3	6.1	13	7.2	7.2	8	8.9	8.1
H	9	5.2	5.9	16	5.3	5.6	9	6.1	6.3	13	7.7	7.6
I	7	5.2	5.7	14	5.8	6.1	7	8.1	8.2	11	7.8	7.8
J	5	5.1	5.6	12	5.2	5.6	9	7.8	7.6	7	7.5	7.5
K	8	5.7	6.0	9	5.1	5.7	7	7.7	8.0	8	8.4	8.2
L	14	5.8	6.0	11	5.7	5.8	10	7.4	7.2	11	7.8	7.1
Range	5.1-6.0 5.5-6.2			5.1-6.0 5.6-6.2			6.1-8.7 6.3-8.4			7.3-9.1 7.1-9.1		

experiments makes it impossible to compare the results with the norms established for seeing children. It is current practice in the testing of blind children to extend the time limits which were established in standardizing tests with seeing children. Hayes recommends: ". . . in group tests blind children should be allowed approximately three times as long as the seeing to complete a standardized test involving the reading of braille with the possibility of some shortening of this allowance after the children have become accustomed to the special technique involved."¹⁵ This procedure could not have been applied to the present experiments because only by disregarding the time limits for braille and Talking Book tests alike was it possible to fully evaluate the differences between the two modes of reading. There are however some interesting points revealed when the average grade scores and also the age scores for each reading mode are compared with the actual mean ages of the pupils at the four grade levels.

Table 18 presents the actual grades and the mean ages of the pupils at the time of the experiments, the mean grade scores and corresponding

TABLE 18
MEAN GRADE AND AGE SCORES* IN BRAILLE AND TALKING BOOK READING
COMPREHENSION OF PUPILS IN THE FOUR GRADES

Actual Grade	Mean Age	BR		TB	
		Grade Score	Age Score	Grade Score	Age Score
3.7	11.4	5.4	10.9	5.7	11.2
4.7	12.5	5.5	11.0	5.9	11.5
6.7	14.9	7.6	13.2	7.5	13.1
7.7	15.7	8.1	13.8	7.9	13.6

*Age scores, representing the age norms which correspond with the G scores listed, are taken from a table of Ages and G Norms in *Standard Test Lessons in Reading*, Manual of Directions, p. 11.

age scores for braille and for Talking Book reading comprehension. It can be seen from the braille as well as from the Talking Book reading G scores that the pupils are considerably above their grade placement in the third grade with the difference decreasing as the grades progress. This superiority may, at least in part, be due to the omission of the time limit but could also indicate that the pupils are in their reading achievement above their actual grade.

¹⁵ Hayes, Samuel P. *Contributions to a Psychology of Blindness*. New York: American Foundation for the Blind. 1941. p. 240.

Pintner states: "Grade norms for the blind and the seeing are pretty much the same. This means that the grade standards in schools for the blind are kept fairly similar to those in seeing schools."¹⁶ However, as pointed out previously, pupils in schools for the blind show considerable overageness when compared with the age-grade standards established for seeing children. For this reason a comparison based on age scores appears to be more adequate than one using grade scores. In the present experiments, which disregard the time limit set for seeing children, the age scores in braille and in Talking Book reading on the third grade level almost correspond with the mean age of the pupils—10.9 and 11.2 compared with 11.4. However, as the grades progress the age scores fall increasingly behind the mean age of the pupils. For braille reading comprehension, the difference is 1.5 years for the fourth, 1.7 years for the sixth, and 1.9 years for the seventh grade; and for Talking Book reading comprehension, it is 1.0 years for the fourth, 1.8 years for the sixth, and 2.1 years for the seventh grade. This shows that the age retardation in reading comprehension increases from grade to grade until it amounts to about two years in the seventh grade. (Whether this trend continues after seventh grade cannot be determined on the basis of this study.) The increase in age retardation appears to be independent of the mode of reading.

These results give further support to the following conclusion which Pintner reaches after a survey of the studies on the educational achievements of the blind as measured by standard tests: "... in general the blind start out in their school work more or less on a par with the seeing. Their scores on the various tests are more nearly equal to those of the seeing at the younger ages. As the blind progress through the grades, retardation sets in to a much greater extent than among the seeing."¹⁷

Children's Preferences, Series I (grades 3 and 4)

In order to get some information on the question of which modes of presentation were preferred by the children, the following addition was made to the tests of Series I given to the third and fourth grade pupils. On the last day, after the tests were finished, the children were asked to select the four "stories" which they liked best of all and to list them in the order of their preference. A list of titles for the 24 test lessons was read to them but they were told that, in indicating their

¹⁶ Pintner, Rudolf; Eisenson, Jon; and Stanton, Mildred. *The Psychology of the Physically Handicapped*. New York: F. S. Crofts & Co. 1941. pp. 228-229.

¹⁷ *Ibid*, p. 228.

preferences, they could make up titles themselves if they could not remember those read to them. Most of the children responded very readily to this task and seemed to have no trouble at all in selecting the four test lessons which they liked best.

The responses of the pupils were tabulated in two ways: (1) the frequency of selection for each of the 24 test lessons was determined and the test lessons were then grouped by modes of presentation; and (2) the selections were weighted according to their rank order by assigning 4 points to first choices, 3 points to second, 2 points to third, and 1 point to fourth choices, and the weighted frequencies were grouped by modes of presentation. The figures of both tabulations were transformed into percentages and are presented in Table 19. Assuming

TABLE 19
PREFERENCES IN TEST STORIES ARRANGED BY MODE OF PRESENTATION

MODE OF READING	FREQUENCY OF SELECTION IN PERCENTAGES			WEIGHTED FREQUENCY OF SELECTION IN PERCENTAGES		
	<i>Grade 3</i>	<i>Grade 4</i>	<i>Total</i>	<i>Grade 3</i>	<i>Grade 4</i>	<i>Total</i>
BR	12.8	10.4	11.6	9.5	10.1	9.8
TB	11.3	20.7	16.0	10.3	18.3	14.3
TBS	40.5	36.6	38.5	40.7	37.3	39.0
TBD	35.4	32.3	33.9	39.5	34.3	36.9
Total	100.0	100.0	100.0	100.0	100.0	100.0

a uniform distribution the theoretical frequency of selection would be 25 per cent for each of the four modes. It is of course recognized that the content of the passages by itself accounts for some of the preferences. However, the results are so clear cut that the mode of presentation appears to be the main factor determining the preferences. The percentage distribution indicates very distinctly that the pupils of the third and of the fourth grade preferred passages presented in Talking Book form either with sound effects or with dramatizations. Both methods of evaluation, frequency of selection and weighted frequency of selection, give approximately the same results. This shows that the pupils not only preferred passages with sound effects and with dramatizations among the 24 test passages as a whole but also gave them preferred ranking within the group of four selected by them. Only 27.6 per cent of the test passages chosen by the children were in Talking Book straight reading and in braille. The difference in percentage of preference between these two modes is very small for the third grade

but pupils of the fourth grade chose twice as many Talking Book straight reading passages as braille passages. Of the test lessons selected 72.4 per cent were presented on the Talking Book with sound effects or with dramatizations, the former mode having a slightly larger percentage than the latter. The percentages for the weighted frequency of selection follow the same pattern for the four modes.

It should be noted that the arrangement of the experiments did not make it possible to determine the preferences of children when the choice was only between braille and Talking Book straight reading. It is recognized that different results might be obtained if passages were presented only in these two modes.

In order to demonstrate how consistent the preferences of the children for the test passages were, the choices of the third grade pupils were compared with those of the fourth grade pupils. This comparison reveals a great similarity. Rank lists were made in which the frequency of selection determined the order of the passages. The rank order correlation (ρ) between third and fourth grade selections is .82. When the rank order of preferences weighted by points is used ρ is .80. These high correlations indicate that both groups preferred the same passages with a high degree of uniformity.

Anyone who was present when the test lessons were given can testify that the overt reactions of the pupils also gave evidence of their preferences. Test lessons presented on the Talking Book with dramatizations and with sound effects evoked signs of emotional response from the pupils. They giggled and showed their pleasure in listening to the story of Daniel Webster, for instance, and, after a group had listened to the burning of the forest fire and the description of it in the test lesson, such remarks as, "Gee, that must be terrible!" could frequently be heard. Some pupils, however, stressed in casual conversations that they preferred to read their stories in braille. Invariably, such pupils were the ones who had finished their braille reading before the others. It may be that their proficiency in braille reading makes them prefer this mode or that they are proud of being ahead of their classmates and therefore want to put on record their pleasure in reading braille.

Of course, the children's preference for Talking Book reading either with sound effects or dramatized is only one aspect to be considered in the evaluation of the two reading media. So far as our experiments are concerned the children's preferences indicated that sound effects and dramatizations contributed definitely to the attractiveness of the material presented. This suggests the use of dramatizations and sound effects for the purpose of stimulating reading interest.

CHAPTER IV

SUMMARY AND RECOMMENDATIONS

Purpose of the Study

It was the purpose of this study to compare the effectiveness of braille and Talking Book reading in regard to speed and comprehension and also to consider the preferences of blind children for one or the other mode of reading.

Procedure

In Series I of the experiments 122 third grade and 138 fourth grade pupils of twelve residential schools for the blind were given 24 tests selected from the McCall-Crabbs *Standard Test Lessons in Reading*. Six test lessons were presented in each of the following modes:

1. Braille reading
2. Talking Book reading
3. Talking Book reading with sound effects
4. Talking Book reading with dramatizations.

The comprehension scores of the pupils and their rates of braille reading form the material for the statistical analysis of the study. Comprehension scores of the four modes of reading were compared for the two grades and those of braille and Talking Book straight reading also for different levels of intelligence. Rates in braille reading (braille, grade one and a half) were determined for third and for fourth grade and were compared with the Talking Book straight reading rate and with norms for visual silent reading. Attention was also given to variation in braille reading rate on each grade level for the various schools participating in the study.

The pupils were asked to list the four stories they liked best in the order of their preference and their responses were tabulated according to modes of reading.

In Series II, 109 sixth grade and 112 seventh grade pupils were given 12 tests selected from the McCall-Crabbs *Standard Test Lessons in Reading*, 6 of which were presented in braille and 6 in Talking Book straight reading. The tests in each mode of presentation included three *story-telling* passages and three *textbook* passages. Braille and Talking Book reading comprehension scores on each type of material were compared for the two grades and for different levels of intelligence. Rates

of braille reading (braille, grade one and a half) were analyzed as in Series I.

Conclusions

Rate of Reading. The median rates of braille reading on graded material are as follows: for third grade, 51; for fourth grade, 58; for sixth grade, 59; and for seventh grade, 62 words per minute. A comparison of rates of braille reading from school to school reveals that there are great differences in the median rates for any one grade level—at each level the highest median found is about twice the lowest. The results also indicate that the pupils in one school tend to belong either to the group of slow-rate readers or to that of fast-rate readers.

The Talking Book reading rate in the present experiments was 171 words per minute for the third and fourth grade tests and 158 words per minute for the sixth and seventh grade tests. On this basis pupils of the four grades in the study read on the average 30, 34, 37, and 39 words respectively in braille for each 100 words read on the Talking Book—or, roughly, about one-third as fast in braille as by Talking Book.

When the braille reading rates are compared with norms for silent visual reading, it is found that seeing pupils on the third grade level read about twice as fast as blind pupils; on the fourth grade level, about three times; on the sixth grade level, about three and a half times; and on the seventh grade level, about four times as fast.

Reading Comprehension. On the third and fourth grade level (Series I), comprehension by Talking Book straight reading is significantly superior to that of braille reading by a margin of about 4 months in grade score achievement. The difference in comprehension between Talking Book reading and Talking Book reading with sound effects is very small and statistically not significant. The results in regard to Talking Book reading with dramatizations indicate a need for further experimentation because the passages used in this study were too short for effective dramatization.

The comparison of braille and Talking Book straight reading scores for different IQ groups on the third and fourth grade level indicates that the differences in favor of Talking Book reading are considerably greater for pupils in the group with IQ's below 90 than for those in the higher IQ groups. This shows that, on this grade level, pupils of lower intelligence comprehend much better by Talking Book than by braille reading while the more intelligent pupils comprehend well by either mode of reading although there is still a difference in favor of

Talking Book reading. A comparison of the standard deviations for each of the four modes of reading reveals that Talking Book reading results in a more homogeneous group of scores than braille reading and that the addition of sound effects or dramatizations to Talking Book reading accentuates the differences from pupil to pupil.

In Series II (sixth and seventh grades) the differences in comprehension for *story* tests are small and insignificant, demonstrating that pupils comprehend this type of material as well by braille reading as by Talking Book reading. For *textbook* tests, comprehension scores in braille reading are significantly superior to those in Talking Book reading by a margin of 5.3 and 4.5 educational months for sixth and seventh grades respectively. These results may be explained by "past practice and habituation" since pupils are used to comprehending informational textbook material by braille reading rather than by listening. The difference in favor of braille is considerably larger for pupils in the group with IQ's below 90 than for those in higher IQ groups. In addition to the above-mentioned factor of "past practice and habituation" the opportunity to adjust reading speed to comprehension, which is a concomitant of braille but not of Talking Book reading, may explain these results. The scores for braille and for Talking Book reading show the same amount of scatter.

The correlations between the present test scores and the IQ's of the pupils range from .22 to .55 for the four grades in this study and correspond with those generally reported for reading and intelligence measures.

The reliability of the tests is demonstrated by the correlations between the different modes of reading. Talking Book reading and Talking Book reading with sound effects, the two reading modes most alike, show correlations of .83 and .73 for the third and fourth grades respectively. Correlations of the test scores between the other modes on the four grade levels range from .56 to .75. The correlations indicate a very considerable reliability of the tests as used in this study.

The achievement in comprehension as expressed by the median scores for braille and Talking Book straight reading shows differences from school to school within any one of the four grade levels, as would be expected. While these differences are small on the third and fourth grade level they are very considerable on the sixth and seventh grade level. Also, some schools show either consistently low or consistently high achievement for the four grades in the study. These facts might be explained by a genuine difference in comprehension ability of the pupils in the various schools, or by differences in teaching methods affecting comprehension, or by a combination of both.

Although it was observed that some schools show high rates as well as high comprehension scores in braille reading, the design of the study did not permit any conclusions on the correlation of rate and comprehension.

The omission of the time limit in the experiments makes it impossible to compare the scores with the norms for seeing pupils. The grade scores in braille as well as in Talking Book reading are above the actual grade of the pupils. The age scores practically correspond with the mean age on the third grade level but fall increasingly behind from fourth to seventh grade. At the seventh grade level the age retardation in both braille and Talking Book reading comprehension amounts to about 2 years.

Children's Preferences. Of the stories selected by the children as their preferred ones, about 10 per cent were read in braille; about 15 per cent on the Talking Book (straight reading); about 35 per cent on the Talking Book with dramatizations; and about 40 per cent on the Talking Book with sound effects. This distribution of the children's preferences seems to indicate that sound effects and dramatizations add considerably to the attractiveness of the material presented.

Recommendations

The results of this study permit the formulation of recommendations along two lines: (1) in regard to braille reading; and (2) in regard to the use of the Talking Book as a supplementary reading medium.

Braille Reading. The slowness of braille reading is generally regarded as a major factor contributing to the age-grade retardation of blind children. Individual differences in comprehension and rate occur in any group because of prevailing differences in intelligence. However, in comparing group data, it was found that the median rate of some classes is almost twice that achieved in the same grade in other schools and also that comprehension differences, particularly on the sixth and seventh grade levels, are unduly large. The differences revealed by this study demonstrate that there is ample ground for improvement. The general level of braille reading may be raised if better instructional methods are used and if reading for rate and comprehension receives greater attention, particularly with classes and with individual pupils that show scores below the average. The data also support the assumption that some of the schools as a whole do not sufficiently stress the speed and comprehension factors in their teaching of braille reading.

In this connection, the pattern in teaching braille followed in most American schools for the blind should be considered. There are three

"grades" of braille taught: grade one is uncontracted; grade one and a half makes use of some contractions; and Standard English Braille, grade two is the still further contracted system now generally accepted in all English-speaking lands. Pupils are first taught grade one, learn grade one and a half in the second or third school year, and begin to learn grade two in the sixth or seventh school year. The textbooks conform with this pattern; books from the third school year on are in general available in grade one and a half and books from the eighth school year on in grade two. Naturally the availability of books in accordance with this sequence contributes toward perpetuating it. (The braille tests of the present study were given in braille, grade one and a half, since even on the seventh grade level braille, grade two was not familiar to all students.)

Introducing grade two, the more contracted system, to pupils at an earlier age offers one possibility of increasing the rate of braille reading. The fact that the present pattern of teaching braille makes it necessary for the pupils to shift from uncontracted braille to braille, grade one and a half and then to the final grade two, which has more contractions and different rules for the use of contractions, means that often three different word forms must be learned for one word. The elimination of grade one and a half as a fixed intermediary step should be considered as another expedient in promoting braille reading.

Talking Book Reading. The Talking Book has not yet been used widely enough in schools for the blind to exert any influence in compensating for the slowness of braille reading. The results of this study prove the potential value of the Talking Book as a supplementary reading medium. The following recommendations are made:

1. Since pupils on the third and fourth grade level read about three times as fast by the Talking Book as in braille and since comprehension of Talking Book reading is superior to that of braille reading, the use of the Talking Book at this level is strongly recommended in order to compensate at least in part for the slowness of braille reading. Planned use of the Talking Book will not only make it possible to increase the volume of reading but also to gain time to promote efficiency in braille reading. Thus the experiences of blind children will be enriched and they will gain a wider informational background which can be expected to lead to a decrease in their age-grade retardation.

2. Sound effects and dramatizations used in connection with Talking Book reading are an attractive feature, the use of which is suggested to stimulate reading interest in blind pupils. Since the addition of sound

effects resulted in the same superior comprehension as that of Talking Book straight reading, the use of sound effects is recommended without any reservation. No definite recommendations can be made in regard to the use of dramatizations in general, although the short dramatizations used in the present experiments affected reading comprehension adversely.

3. On the sixth and seventh grade level where pupils have acquired some proficiency in braille reading the use of the Talking Book is recommended because its rate, which at this level is about two and a half times as fast as that of braille reading, will permit much wider reading. The study has shown that in spite of the faster rate Talking Book narrative reading results in comprehension that is equally as good as that by braille reading. Only for informational *textbook* material is comprehension by braille reading superior, particularly for pupils of lower intelligence. It seems therefore advisable to have informational material for which the fullest possible comprehension is essential read in braille. In fields where volume of reading is more important the Talking Book has the decisive advantage of rate.

4. Many pupils of lower intelligence never achieve any real proficiency in braille reading in spite of long and laborious instruction and practice. The use of the Talking Book is particularly recommended with these pupils.

5. Pupils in schools and classes for the blind should be given opportunities to use Talking Book machines for classroom as well as out-of-school reading.

6. In order to supply teachers and pupils in schools and classes for the blind with those Talking Books which will be most useful, it is suggested that the American Printing House for the Blind increase the production of Talking Books for use with children of school age, recording books in which the subject matter is directly correlated with the courses of study for the various grade levels as well as books for general supplementary reading and for pleasure reading.

The results of this study are to be regarded as indicative only of conditions prevailing at the time of the experiments. Changes in emphasis, methods, and practices must affect the achievement of the pupils and may result in different basic data. Consequently it can by no means be a final dictum, for instance, that on the sixth and seventh grade level *textbook* material is better comprehended in braille than on the Talking Book.

The true value of the Talking Book as an educational medium will be realized only when:

1. Blind pupils get used to the Talking Book as a reading medium, and purposive listening techniques are developed.
2. Techniques adapted to the presentation of informational material are developed, such as those for place-finding, rereading, emphasizing, summing up, etc.
3. Methods of using sound effects and dramatizations are further tried out and developed.
4. Recording techniques are perfected.
5. Braille and Talking Book reading are purposefully coordinated.
6. Ample material is made freely available.

APPENDIX

SAMPLES OF TEST LESSONS¹

SERIES I

BRAILLE READING.

From Book III. No. 38.

The king of Shu had no arrows for his soldiers. Chu-Koh-Liang, the adviser of the king, promised to get five thousand arrows before the battle. It takes a long time to make so many arrows. The king thought it was strange that Chu-Koh-Liang did not tell the arrow-makers to start work. Chu-Koh-Liang would not tell his plan. He waited until the evening before the battle. At midnight he sent twenty boats covered with thick straw pads to sail around the enemy's camp. The enemy were frightened and shot many arrows at the boats. The arrows stuck in the straw. The boats sailed back and Chu-Koh-Liang took out more than five thousand arrows and gave them to the king. The enemy had very few arrows left with which to fight.

1. To make thousands of arrows takes (a) one day; (b) two hours; (c) a long time; (d) a short time.
2. Chu-Koh-Liang got the arrows from the (a) enemy; (b) factory; (c) arrow-makers; (d) general.
3. The king of Shu needed (a) bows; (b) guns; (c) arrows; (d) soldiers.
4. Chu-Koh-Liang was the king's (a) cousin; (b) friend; (c) general; (d) adviser.
5. Chu-Koh-Liang sent the boats (a) the next morning; (b) at the time of the battle; (c) the evening before the battle; (d) the day after the battle.
6. How many arrows did he promise to get? (a) 500; (b) 5000; (c) 50,000; (d) 50.
7. The enemy (a) ran away; (b) were asleep; (c) sent out boats; (d) shot many arrows.
8. The arrows (a) fell into the water; (b) stuck in the straw; (c) killed the men; (d) fell on the ground.
9. At the time of the battle the enemy had (a) many arrows; (b) no arrows; (c) very few arrows; (d) more arrows than before.

¹ Reprinted or adapted from McCall-Crabbs *Standard Test Lessons in Reading*, edition of 1938. New York: Teachers College, Columbia University.

10. The boats were covered with (a) cotton; (b) cloth; (c) feathers; (d) straw.

No. right	0	1	2	3	4	5	6	7	8	9	10
G score	1.5	2.7	3.4	3.9	4.4	4.8	5.3	5.7	6.1	6.7	7.2

TALKING BOOK READING.

From Book II. No. 88.

A man living in Norway is putting tags on whales in the cold waters of the North. This tag is a metal disk with the man's name and a number printed on it. The tag has a barbed point, something like the point of a fishhook, which holds it on the whale. It is shot from a gun and this barbed point sinks into the whale's hide and holds the tag on as long as the whale lives.

He is tagging these whales because some people claim that the whales are being killed off so fast that there will be none left in a few years. He wants to prove that this is not true. He is very anxious to do this, because his country, Norway, leads the world in catching whales. He also hopes to find out to what waters these whales go in swimming from sea to sea.

TALKING BOOK READING WITH SOUND EFFECTS. *From Book III. No. 81.*

Have you ever seen a forest fire? It is terrible to watch the flames run along the ground licking up the leaves and dead branches. (SOUND: crackling of fire) It is no wonder that those whose homes are near gather quickly to fight the fire. If the fire cannot be stopped these people will lose everything. (SOUND: crackling of fire, louder) Water can seldom be used to put out a forest fire for most of the time water cannot be had. Instead of using water the men fight fire with fire. With hoes, shovels, and rakes they make a broad, clean path through the forest some distance ahead of the fire. (SOUND: crackling of fire, background to end) Then they set "back-fires" along that side of this clean path which lies toward the coming fire. These "back-fires" burn slowly toward the main fire. When they meet both must die out for lack of fuel.

TALKING BOOK READING WITH DRAMATIZATIONS. *From Book II. No. 52.*

NARRATOR: A little boy walked up to a big policeman and said:

BOY: "I have come for my ten dollars."

POLICEMAN: "Your ten dollars! What do you mean?"

BOY: "I am the boy who gave you the purse I found with \$10 in it."

You told me that it would be mine if no one else claimed it in six months. It is now more than six months."

NARRATOR: The policeman shook his head, puzzled, but said:

POLICEMAN: "You had better go with your mother to see the chief."

NARRATOR: The mother told the chief of police all about how her son had found the money and given it to the policeman. The officer was greatly pleased and took the boy to the mayor, who gave him the ten dollars and the purse. In the purse the boy found a beautiful honor card of the city.

SERIES II

BRaille READING—STORY TYPE.

From Book V. No. 48.

A Persian ruler owned a rarely beautiful pearl. He had three sons. He decided to give the jewel to the one who had shown the greatest nobility of character. He called his sons and asked them to tell him the most worthy act they had done during the last year.

The eldest son was the first to reply. He said, "The previous week a merchant intrusted me with some precious jewels. I could have taken a few of them and he never would have known it. But I chose to be honest and deliver them all."

"Well done," the father said, "but you could hardly have done otherwise. It would have been shameful to rob a man who had placed such confidence in you."

The ruler then turned to the second son, who said, "As I walked by the lake the other day, I saw a child that was drowning. I quickly jumped into the lake and rescued him."

"Your heroism is certainly to be commended," said the father, "but it would have been cowardly and ignoble to have allowed the child to drown."

Then the third son spoke. He said: "Recently, as I was crossing the mountains, I saw that one of my worst enemies had rolled, while sleeping, near the edge of a precipice. He was a man who had done me a great deal of harm. I could very easily have passed by and allowed him to remain in his dangerous position. However, I felt that it was my duty to waken him, and thus probably save his life. I knew that he would not thank me for my kindness. Indeed, I felt sure that he would not understand it, and would be angry with me. Nevertheless, I awakened him and my only reward was his wrath."

"That was indeed a noble act," said the father. "Take the pearl, my son, it is yours."

TALKING BOOK READING—STORY TYPE.

From Book IV. No. 80.

As a sailor and a rabbit were walking through a forest, they found at different times a railroad spike, a porcupine needle, and a giant fire-cracker. Each time the sailor picked up the article and put it away, saying to his companion that it might come in handy some day. After a time it began to rain; so they sought shelter in a cave which had been made into a kind of den with a door, which the two securely fastened as they entered. Soon a voice from the outside demanded to know who was in his house. The saucy sailor replied that he would like to know who wanted to know.

The outsider said, "It is I, the king of beasts, and you had better let me in. If you don't, I shall cut you to pieces with my claws."

The lion placed his foot near the bottom of the door so that his claws would be seen on the inside. The rabbit was sorely afraid but the sailor boldly scorned the sight; and, sticking the railroad spike under the door he remarked that the lion had nothing in the way of claws. The lion, not to be outdone, said he would chew them to pieces and to prove it he placed his mouth at the bottom of the door so that his whiskers could be seen. This made the rabbit more afraid and he begged the sailor to let the lion in so that he wouldn't devour them. But the sailor merely called out that the lion's whiskers were not to be compared with his, and he placed the porcupine needle under the door. As a last resort the lion roared until the forest resounded with his powerful voice. This indeed frightened the poor rabbit. As he was imploring the sailor to go no further with his bluffs, the sailor fired the giant cracker. The noise was entirely too much for the lion, and he left the den for the sailor and rabbit to live in happily ever after.

BRAILLE READING—TEXTBOOK TYPE.

From Book IV. No. 69.

The United States probably suffers more from injurious insects than any other country in the world, because there has come here with migrations of people a large number of foreign insects without their natural enemies. In this country alone insects destroy yearly materials and goods estimated to be worth two hundred million dollars. The damage done to our crops by their activities amounts to from six to eight hundred millions.

Insects are especially active as disease carriers. Almost every domesticated animal has its serious insect enemy and man himself is not immune. The household fly carries thirty kinds of disease and parasites. Mosquitoes are responsible for malaria; the tick for Rocky Mountain fever. They also carry fatal diseases to many important crops.

To fight these diseases we must fight the insect carriers and control them. But it is hard to fight insects because they adapt themselves to all sorts of conditions, and because their size has so often obscured their destructive powers.

This country has gone furthest in its scientific study of insects and methods of control. France and Italy have shown themselves keenly alive to the importance of the work and Great Britain is developing many workers in her colonial possessions. Some remedial treatment has been found for almost every injurious insect in the United States, but the fight calls for more trained workers and a large expenditure of money.

TALKING BOOK READING—TEXTBOOK TYPE.

From Book IV. No. 40.

In wandering through a museum, did you ever pause before some wonderfully mounted specimens of animals and ask yourself just why the government should expend so much money on them and make every effort to see that we have museums filled with rare collections, scientifically mounted, coming not only from our country but from many others?

As civilization spreads farther and farther west, wild animals become more rare and, unless protected, extinct. The old settlers tell of the time when the buffalo roved the west in herds; yet where are they today? Sadly we hear some one say that the circus has seen its best days. It is hard for the zoos to keep a supply of wild beasts. Have you ever stopped to think that the market quotations on the lion are from eight hundred to two thousand dollars? This is because perfect lions are rare. The death rate on captive wild animals is very high, even when we can pay the price.

It seems almost inevitable that in the near future we shall know some animals only through pictures or exhibits in museums. Therefore, the government preserves these so that school children and the visiting public may profit by them.

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